**Binomial Distributions**

4 conditions:

* Must have a
* All of the observations
* Only
* The probability

Notation:

µX= σX=

**Binomial Probabilities**

* We already know the formula for this!
* Binomial random variables are just…
* Formula:
* Example: Computer chips have a 25% chance of being defective. Create the probability distribution for X, if X is the # of defective chips in a sample of 4.

|  |  |
| --- | --- |
| **X** | **P(X)** |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

So let’s answer some easy questions:

**P(X=2) =**

**P(X<2) =**

**P(X≥3) =**

**P(2≤X≤4) =**

Now let’s look at changing the sample size to **10**, and answering similar questions:

|  |  |
| --- | --- |
| **X** | **P(X)** |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |

**P(X=9) =**

**P(X<4) =**

**P(X≥6) =**

**P(5≤X≤7) =**

Would you want to answer these questions for a sample size of 30? Of 50? Of 100?

**So we can use the calculator**

**For P(X=k)**

* Use
* k =
* pdf =

**For P(X≤k)**

* Use
* k =
* Notice that is ONLY GIVES YOU
* cdf =

**However you MUST still write \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Example:**

* John is taking archery.
* He has a 30% chance of hitting the target each time he shoots.
* He shoots 8 times

1. What is the probability that he hits the target 4 times?
2. What is the probability that he hits the target 2 times or less?
3. What is the probability that he hits the target at least 3 times?
4. What is the probability that he hits the target less than 5 times?
5. What is the probability that he hits the target more than 6 times?

**Try this example on your own:**

* **150 businesses are sent mailings asking them to answer a survey question and send the mailing back. The probability of nonresponse is 55%.**

1. **What is the average number of businesses that WILL respond?**
2. **What is the standard deviation of the number of businesses that WILL respond?**

**The rest of the questions deal with the binomial random variable X, where X is the number of businesses that WILL respond.** Don’t forget your prob. notation!

1. **What is the probability that 75 businesses will respond?**
2. **What is the probability that 60 businesses or less will respond?**
3. **What is the probability that 60 businesses or more will respond?**
4. **What is the probability that less than 60 businesses will respond?**
5. **What is the probability that greater than 60 businesses will respond?**
6. **What number of surveys would you have to send out if you wanted to be able to expect to get 90 back?**

# AP Statistics Section 5.1 – Binomial Distribution

1. Which of the following are binomial experiments or can be reduced to binomial experiments?
2. Surveying 100 people to determine if they like Sudsy Soap.
3. Tossing a coin 100 times to see how many heads occur.
4. Drawing a card from a deck and getting a heart.
5. Asking 1000 people which brand of cigarettes they smoke.
6. Testing 4 different brands of aspirin to see which brands are effective.
7. Testing 1 brand of aspirin using 10 people to determine whether it is effective.
8. Asking 100 people if they smoke.
9. Checking 1000 applicants to see whether they were admitted to White Oak College.
10. Surveying 300 prisoners to see how many different crimes they were convicted of.
11. Surveying 300 prisoners to see whether this is their first offense.
12. A burglar alarm system has 6 fail-safe components that act independently. The probability of each failing is .05. Find the following probabilities.
13. Exactly 3 will fail.
14. Fewer than 2 will fail.
15. None will fail.
16. If a student takes a 10-question multiple choice quiz with four choices for each question, find the probability of guessing at least 6 correct.
17. In a Gallup survey, 90% of the people interviewed were unaware that maintaining a healthy weight could reduce the risk of stroke. If 15 people are selected at random, find the probability that at least 9 are unaware that maintaining a proper weight could reduce the risk of stroke.
18. It was found that 60% of American victims of health care fraud are senior citizens. If 10 victims are randomly selected, find the probability that exactly 3 are senior citizens.
19. Find the following probabilities for a sample of 9 children if 60% of them had German measles by the time they were 12 years old.
20. At least 5 have had German measles.
21. Exactly 7 have had German measles.
22. More than 3 have had German measles.
23. Find the mean, variance, and standard deviation for the number of heads when 10 coins are tossed.
24. It has been reported that 83% of federal government employees use e-mail. If a sample of 200 federal government employees is selected, find the mean and standard deviation of the number of people who use e-mail.
25. For the data in #8, what is the probability that the number of people using e-mail will lie within one standard deviation of the mean? *(don’t forget that binomial variables are DISCRETE)*
26. In a restaurant, a study found that 42% of all patrons smoked. If the seating capacity of the restaurant is 80 people, find the mean, variance and standard deviation for the number of patrons smoking.
27. For the data in #10, what is the probability that the number of smokers will lie within 1.5 standard deviations of the mean? *(don’t forget that binomial variables are DISCRETE)*